

# SYSTEMATIC STUDIES ON *JACOBSONIA* (ACARI, MESOSTIGMATA), A MITE ASSOCIATED WITH INDO-MALAYSIAN MILLIPEDES<sup>1</sup>

Estudios sistemáticos de *Jacobsonia* (Acari, Mesostigmata), un ácaro asociado con un milpiés Indo-Malásico

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## RESUMEN

Se describe una nueva especie de ácaro mesostigmata, *Jacobsonia berlese* n. sp., asociado con un milpiés recolectado en Indonesia-Java. Se entregan comentarios acerca de la posición sistemática del género *Jacobsonia*.

## ABSTRACT

*Jacobsonia berlese* n. sp. is proposed for a mesostigmatic mite associated with indo-malaysian millipedes. Some remarks about the systematic placement of the genus *Jacobsonia* are included.

KEYWORDS: Mesostigmata. *Jacobsonia berlese* n. sp. Systematics. Morphology.

## INTRODUCCION

The greatest diversity of mite-arthropod associations occur with Mesostigmata mites. Hunter and Rosario (1988) reported that 45 families and 285 genera of mesostigmatid mites are associated with arthropods. Besides insects, millipedes, centipedes and crustaceans also show associations

with mites, but little is known regarding them.

The cohorts Antennophorina (Diplogyniidae, Neotenogyniidae, Paramegistidae and Parantennulidae), Heterozercionina (Heterozercionidae) and cohort Dermanyssina (Eviphidae, Ascidae and Laelapidae) show associations with Diplopoda.

The laelapid mites associated with Myriapoda have been reviewed by Evans (1955), Ryke (1959), Kethley (1978), Hunter and Rosario (1986) and Fain (1987). To date, "*Hypoaspis*" G. Canestrini, 1885, *Iphiolaelaps* Womersley, 1956, *Iphiopsis* Berlese, 1882, *Jacobsonia* Berlese, 1910, *Julolaelaps* Berlese, 1916, *Parajacobsonia* Evans, 1955 and *Scissuralaelaps* Womersley, 1945 have been recorded from the tropical Old World fauna

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of millipedes, and *Narceolaelaps* Kethley, 1978 from a spiroboloid millipede in the USA. Kethley (1978) reported that the deficiency of the New World fauna is simply an artifact of collecting.

The genus *Jacobsonia* was erected by Berlese, 1910 with *Iphiopsis (Greeniella) submollis* Berlese, 1910 as the type species. He shortly described *Jacobsonia submollis* and *Jacobsonia minor*; both species were found on *Scolopendra* sp. from Java. Evans (1955) with specimens of a giant millipede from Malaysia described a new species, *Jacobsonia audyi*.

The present work describes a new species, *Jacobsonia berleseii* n. sp., from an unidentified millipede from Java-Indonesia, and gives some remarks about the systematic placement of *Jacobsonia*.

The Protonymph, Deutonymph, female and male are described with details. All the measurements are in micrometers. The holotype, allotype and paratypes of *J. berleseii* n. sp., are deposited in the Acarology Laboratory, The Ohio State University, Columbus-Ohio, USA.

## MATERIAL AND METHODS

A total of 19 specimens, 12 females, 1 male, 2 deutonymph and 4 protonymph from Indonesia, Java, Pangandaran Natural Preserve recollected by hand from an unidentified millipede on 11-IV-88 by D. E. Johnston and D. L. Wrensch were studied. Morphological observations and measurements were obtained from a compound light microscope equipped with a differential interference and phase-contrast optical system, a drawing attachment and a stage-calibrated eyepiece micrometers.

The specimens were cleared and mounted in Nesbitt and Berlese solutions respectively and sealed with Glyptal insulating varnish on microslides which are deposited in the Acarology Laboratory, The Ohio State University, Columbus, USA. Idiosomal setal notation follows Lindquist and Evans (1965) and leg chaetotaxy follows Evans (1963). In the drawings, black shading indicates the ventral setae.

## Abbreviations

A	: Ambulacrum
a	: Anal seta
ad	: Anterior-dorsal seta
al	: Anterior-lateral seta
av	: Anterior-ventral seta
C	: Corniculi
cx	: Coxa
D	: Deutosternum
g	: Genital seta
Ge	: Gena
hyp	: Hypostomal seta
iv	: Lyrifissure
J <sub>1-6</sub>	: Opisthonal setae
j <sub>1-6</sub>	: Inner podonotal setae
JV <sub>1-3</sub>	: Opisthogastic setae
ls	: Lateral seta
md	: Movable digit
pc	: Palpal claw
pd	: Posterior-dorsal seta
pl	: Posterior-lateral seta
pv	: Posterior-ventral seta
R <sub>1-5</sub>	: Opisthonal setae
r <sub>1-6</sub>	: Podonotal setae
s <sub>1-6</sub>	: Podonotal setae
sc	: Subcapitular seta
ss	: Stout spines
st <sub>1-3</sub>	: Sternal setae
SP	: Spermatheca
t	: Denticles or teeth
Ti	: Tibia
Z <sub>1-6</sub>	: Opisthonal setae
z <sub>1-6</sub>	: Podonotal setae

### *Jacobsonia berleseii* n. sp.

(Figs. 1-19)

**Female** (description based on 12 specimens): Chelicerae (Fig. 1) dentate, with the digits approximately equal length; fixed digit with a thin, anteriorly directed process and tridentate, movable digit (md) with two teeth, pilus dentilus setiform, short; cheliceral corona reduced; antiaxial lyrifissure small. Tectum (Fig.2) well sclerotized, triangulat in outline with denticulate anterior margin.

Subcapitulum (Fig.3) normal in shape, with two pairs of hypostomal setae, hyp<sub>1</sub> missing; seta sc same length of hyp<sub>2</sub> and hyp<sub>3</sub>, Corniculi (C) long, extend beyond the middle of palp-femur, stout, parallel. Deutosternum (D) with 8-9 trans-

verse rows, usually 3-5 denticles (t) per row. Palpal chaetotaxy 2-5-5-10; palp claw (pc) with two tines.

Dorsum (Fig. 4) anteriorly covered by reduced dorsal shield. Dorsal chaetotaxy reduced. Dorsal plate with 16 pairs of setae and 7 pairs of pores. Setae on shield minute, with the exception of  $Z_2$  and  $Z_3$ , at least three times longer than other dorsal setae. Five pairs of marginal setae, and region posterior to dorsal shield with 4 pairs of longer setae.

Venter (Fig. 5). Length 612-750  $\mu$ , width 364-420  $\mu$ . Tritosternum well developed; laciniae long, smooth. Sternal shield strongly sclerotized, minutely punctured; three pairs of sternal setae,  $st_3$  longer than  $st_1$  and  $st_2$ , and two pairs of circular pores; metasternal seta on soft cuticle, post lateral to the sternal shield. Genital shield very reduced, with one pair of short, simple setae. Opisthogastric chaetotaxy reduced; three pairs of short setae present,  $JV_1$ ,  $JV_2$  are medial and  $JV_3$  is lateral in position. Peritreme and peritrematal shield greatly reduced, not extending anteriorly beyond posterior margin of coxa III. Anal plate pear-shaped, weakly sclerotized; post anal seta absent, paranal setae (a) closed to posterior margin of anus. Spermatheca (Fig. 6, SP) normal, opening on posterior margin of coxa III (cx).

Legs well sclerotized with reduced claws and well developed ambulacrum. Leg chaetotaxy as in Table I. The leg chaetotaxy is the most reduced in Mesostigmata (Fig. 9); on genu I and tibia I (Fig. 10) the  $ad_2$  and  $pd_2$ , which are normally present in the larval stage, are deleted. Seta  $pd_1$  on tibia IV is medial in position.

**Male** (description based on 1 specimen): Chelicerae (Fig. 7) with reduced but strong digits; fixed digit unidentate, without pilus dentilis; movable digit (md) with a single pointed tooth. Spermatodactyl three-segmented, basal segment fused to the movable digit. Dorsal seta and cheliceral brush or corona are absent. Tectum well sclerotized, denticulate (Fig. 11).

Subcapitulum (Fig. 8) slightly different as in female. Short and reduced hypostomal process; deutosternum (D) with 7 rows of denticles (t); hypostomal setae (hyp) relatively longer than

in the female.

Dorsum (Fig. 12) partially covered by entire shield. Dorsal shield bigger than in the female; with 16 pairs of short setae, with the exception of  $Z_2$  and  $Z_3$ , and 8 pairs of pores. Soft cuticle posterior to dorsal shield with five pairs of short setae.

Venter (Fig. 13). Length 618  $\mu$ , width 495  $\mu$ . Sternogenital shield sclerotized and long, it extends from the posterior margin of coxa I to the anterior margin of coxa IV. It bears 4 pairs of setae and 2 pairs of circular pores;  $st_2$  and  $st_3$  longer than  $st_1$  and  $st_4$ ; the metasternal setae lie off the shield, in the third inter-coxal region. Opisthogastric region reduced, with only three pairs of short setae and one pair of circular pores. Peritrematal and anal plates as in the female.

Leg chaetotaxy as in female. Tarsus II with three stout spines (Fig. 14, ss). With sexual dimorphism on the shape of legs setae (Fig. 15), lateral setae are strongly spine-like. Distal margin of coxae III and IV with small spurs.

**Protonymph** (description based on 4 specimens): Chelicerae and subcapitulum as in the female. Tectum usually less denticulate than in the female.

Dorsum (Fig. 16) with a podonotal shield with small lateral incisions and a big pygidial shield. Podonotal and pygidial shields cover the entire dorsum. Dorsal chaetotaxy reduced (Table II); 16 pairs of long setae, except  $Z_4$  which is minute. Pygidial shield bears  $Z_5$  and 2 pairs of pores. Setae  $s_6$  and  $Z_4$  off the shields, inserted on soft cuticle.

Venter (Fig. 17). Length 370-395  $\mu$ , width 284-340  $\mu$ . Long sternal plate, bearing setae  $st_1$ - $st_3$ , all similar in length, and pores 1, 2 ( $iv_{1,2}$ ). Opisthogaster with one pair of minute setae and one pair of circular pore present on area between coxa IV. Peritrematal and anal plate as in the female. Leg chaetotaxy reduced (Table I), all coxal setae short and setiform.

**Deutonymph** (description based on 2 specimens): Chelicerae, subcapitulum, tectum and dorsal chaetotaxy as in the female.

Dorsum (Fig. 18) not cover entirely by the dorsal shields Podonotal shield with lateral

incisions and 12 pairs of short setae and 2 pairs of circular pores.

Pygidial shield large, with 3 pairs of setae,  $Z_5$  longer than  $Z_4$  and  $J_3$ , and one pair of pores. Region posterior to pygidial shield with 5 pairs of setae. Laterally, setae of R serie are added (Table II).

Venter (Fig. 19). Length 385-420  $\mu$ , width 292-350  $\mu$ . Sternal plate as in the protonymph, bearing three pairs of sternal setae,  $st_2$  slightly longer than  $st_1$  and  $st_3$  and pores 1, 2. Opisthogaster with four pairs of short setae on area between coxae III and IV. Peritrematal and anal plates as in the protonymph. Leg chaetotaxy as in the female.

TABLE I. Leg chaetotaxy of PN and Female of *J. berlesei* n.sp.

PN:				
Ti	1-1/1/1,1/1	1-0/1,1/1-1	1-0/1,1/1-1	1-0/1,1/1-1
Ge	1-1/1,1/1-1	1-1/0,1/0-1	1-1/0,1/0-1	1-1/0,1/0-0
FEMALE:				
Ti	1-1/1,1/1-1	1-0/1,1/1-1	1-0/1,1/1-1	1-0/1,1/1-1
Ge	1-1/1,1/1-1	1-1/0,1/0-1	1-1/0,1/0-1	1-1/0,1/0-1

TABLE II. Dorsal chaetotaxy of *J. berlesei* n. sp.

PN: j1, j3, j4, j5, j6; z2, z4, z5; s4, s6; J1(PN), J2; Z2, Z4, Z5
DN: j1, j3, j4, j5, j6; z2, z4, z5; s4, s6; r5 J1, J2, J5; Z2, Z4, Z5 R2 (DN), R3 (DN), R4 (DN)

## DISCUSSION

Within the Dermanyssina parasites of Diplopoda, *Jacobsonia* shares features with both hypoaspidine and iphiopsid mites. As on every mesostigmata on millipedes *Jacobsonia* presents a well developed ambulacrum with reduced claws. It shows similarities to *Julolaelaps* such as: reduction of the dorsal and genital plates and reduction of the dorsal chaetotaxy. But these features are also present in different other parasitic Dermanysoidea. The spermatheca is normal for Dermanysoidea.

*Jacobsonia* also presents similarities with *Narceolalelaps*. Both have the same "life-history" parasites of millipedes with females giving birth to protonymphs (Kethley, 1978); peritreme and peritrematal plate greatly reduced; ventral coxal spur, especially on coxae III and IV, present; very reduced chaetotaxy of leg I (neotenous?) and pretarsal claws reduced.

Among the derived characters for *Jacobsonia* are: shape of the spermatodactyl, cheliceral process in the female, loss of postanal seta and reduction of genital and dorsal plates, which are modifications for limited physogastry. The spermatodactyl is complex, three segmented and the basal segment is fused to the movable digit. The shape of the spermatodactyl is apomorphic for this genus and it is probably species-characteristic.

Among the *Jacobsonia* species, *J. audyi* Evans and *J. berlesei* sp.n., are both parasites of millipedes. *Jacobsonia berlesei* n. sp., differs from *J. audyi* in the presence of the female cheliceral process, no pilus dentilus on male chelicerae, no sexual dimorphism in length of dorsal setae, denticulate tectum on both sexes and one pair of genital seta on the new species.

In general *J. berlesei* n. sp., is closer to *J. minor* Berlese, a parasite on *Scolopendra*, than to *J. audyi*. They differ on the number of dorsal setae, reduction of peritreme, presence or absence of male cheliceral pilus dentilis, number of opisthogastric setae and hosts, among other characters.

Females of *J. berlesei* n.sp., give birth to full developed protonymph. This viviparity condition on laelapoid mites has also been reported by Berlese (1910) on *Jacobsonia minor*, Evans (1955) on *Hypoaspis* spp. and Kethley (1978) on *Narceolalelaps gordanus*. Berlese, 1910, however, mentioned that females of *Jacobsonia* give birth to an "hexapodum embryonem", a larval state.

Although we have compared *Jacobsonia* with laelapids such as *Julolaelaps* and *Narceolalelaps*, it is important to mention that the pattern of dorsal sclerotization on the Protonymph and Deutonymph, the form of the chelicerae on immatures and female and the shape of the spermatodactyl are not in agreement with the

characters as presently known in the Superfamily Dermansysoidea. Therefore, the exact systematic position of *Jacobsonia* remains to be determined and it will be solved after a complete study of the free-living and arthropod-associated laelapids is done.

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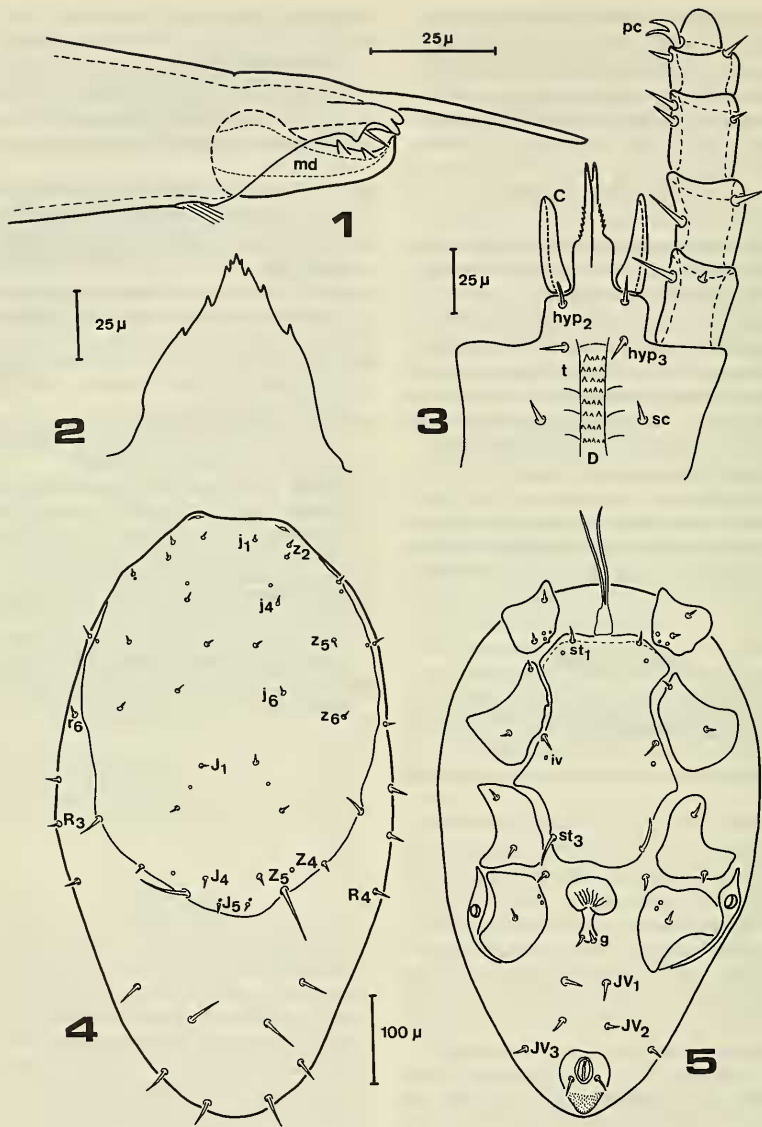


PLATE 1. Figs. 1-5: *Jacobsonia berlessei* n. sp. Fig. 1: Chelicera, female; Fig. 2: Tectum, female; Fig. 3: Subcapitulum, female; Fig. 4: Female, Dorsum; Fig. 5: Female, Venter.

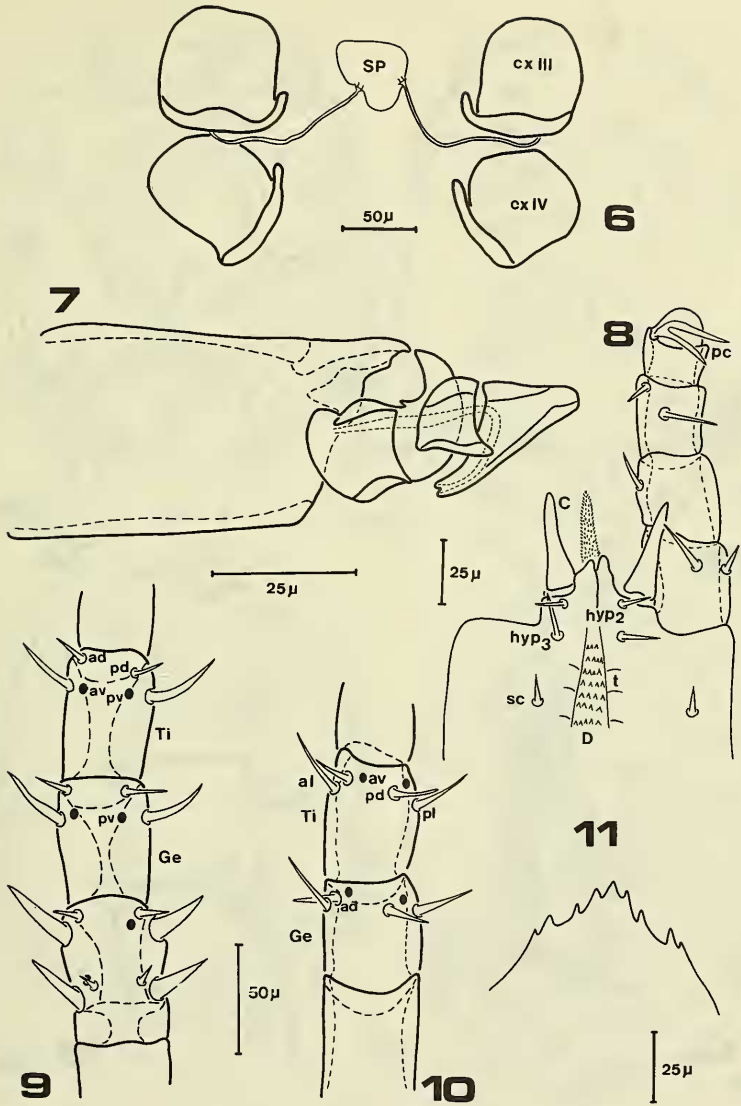


PLATE 2. Figs. 6-11: *Jacobsonia berlessei* n. sp.; Fig. 6: Spermatheca, female; Fig. 7: Chelicera, male; Fig. 8: Subcapitulum, male; Fig. 9: Reduced leg chaetotaxy; Fig. 10: Genua and Tibia I, female; Fig. 11: Tectum, male.

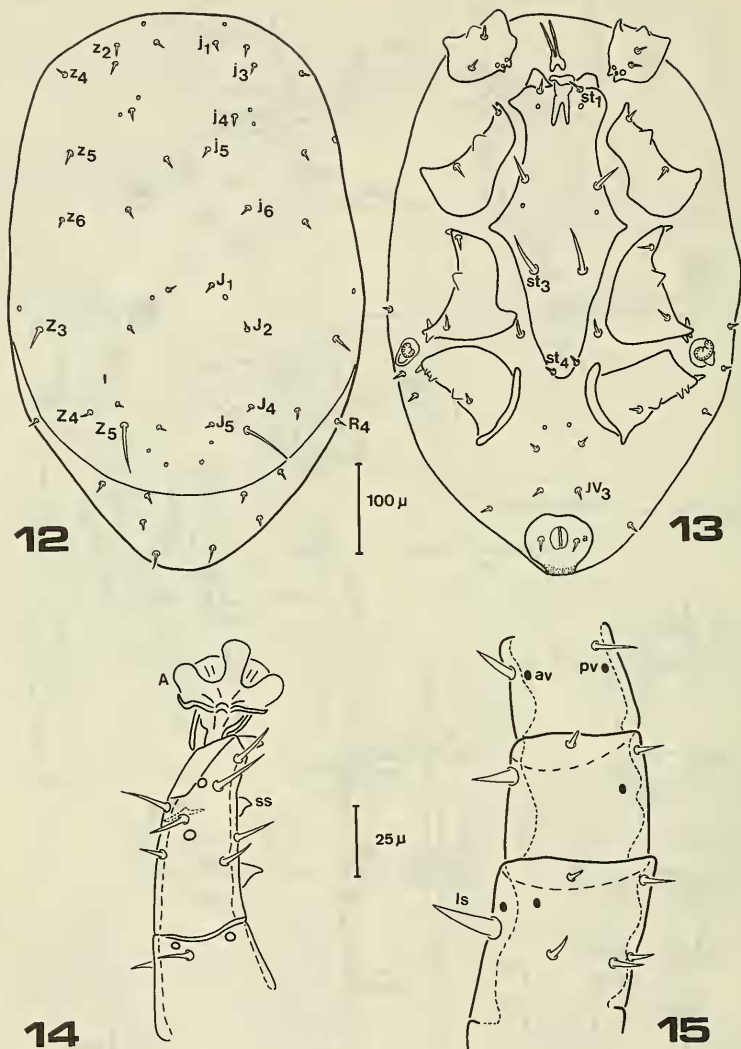


PLATE 3. Figs. 12-15: *Jacobsonia berlesesi* n. sp. Fig. 12: Male, Dorsum; Fig. 13: Male, Venter; Fig. 14: Tarsus II; Fig. 15: Leg II, setal sexual dimorphism.



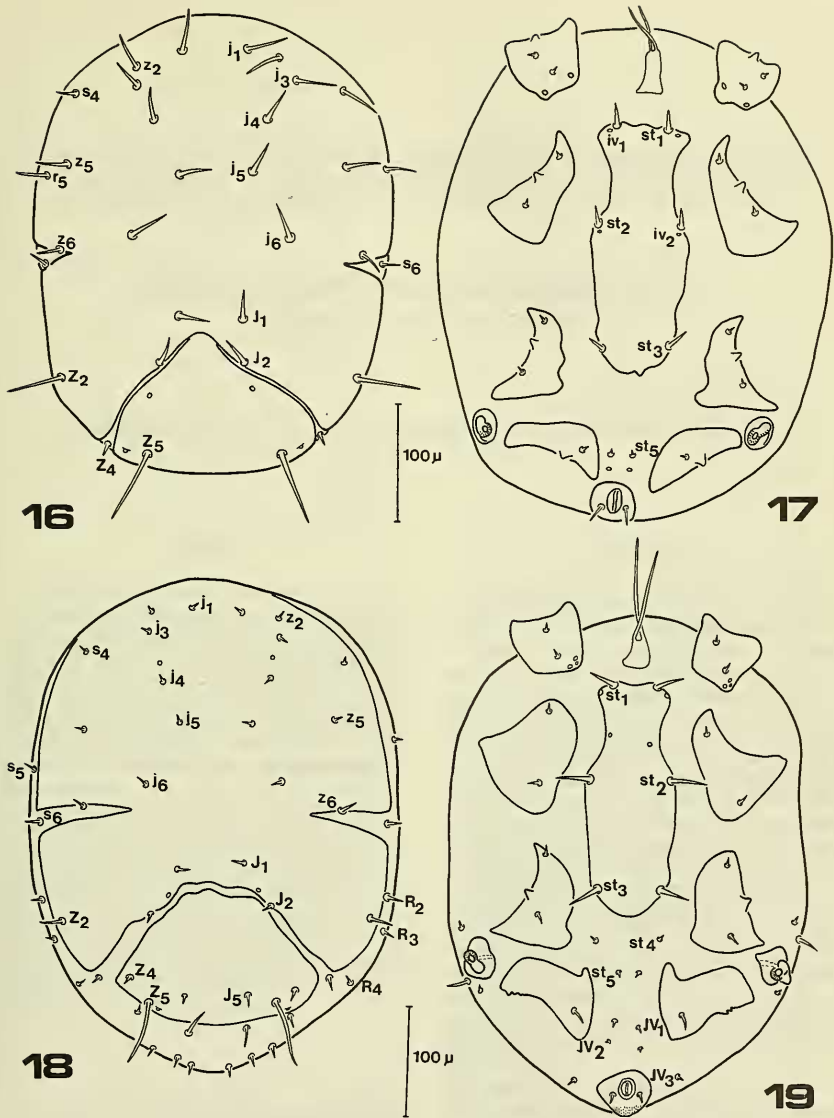


PLATE 4. Fig. 16-19: *Jacobsonia berleseii* n. sp. Fig. 16: Protonymph Dorsum; Fig. 17: Protonymph, Venter; Fig. 18: Deutonymph, Dorsum; Fig. 19: Deutonymph, Venter.